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DRAWINGS ATTACHED

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(54) HEAT EXCHANGER

(71) I, HENRY BRANTS, a Canadian Citizen, whose address is 444 Sanford Avenue, St. Lambert, Quebec, Canada, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement: —

The present invention relates to heat exchangers.

A number of problems face the manufacturer of heat exchangers which are intended primarily for use in domestic hot water systems. The most common is probably the large number of sizes of units which are needed to cover the variety of jobs. Since buildings vary greatly in size, so do the domestic hot water requirements. Thus the manufacturer is called upon to provide heat exchangers with a large range of capacities. At the present time this involves fabricating a specially designed unit for each contract and, of course, this can be a very costly procedure.

In addition, many present day heat exchangers are plagued with the problem of interior leaks. In many cases these are caused by faulty, threaded interior connections. The locations of such leaks are difficult to identify and after the leaks have been located the dismantling of the heat exchanger to rectify the leak is often a large undertaking.

It is, therefore, an aim of the present invention to provide a heat exchanger which may easily be altered in size, which has no interior threaded connection and which may readily be dismantled for repair.

Accordingly, the present invention provides a heat exchanger which comprises a shell having at least two sections; these sections being secured together by bolted flanges, one of said sections forming the top section of the heat exchanger and a second of said sections forming the bottom section of heat exchanger, said top section having a cylindrical wall, a domed top and a heated fluid outlet, said bottom section having a cylindrical wall, a domed bottom and a cold fluid inlet, each section of the heat exchanger incorporating a heating coil which comprises a series of separate tubular coils concentrically wound one within the other, each of these coils providing a helical passageway for heating fluid the upper end of each coil being connected to an inlet header and the lower end of each coil being connected to an outlet header, each of said headers being provided with a main fluid passage connected to each of a plurality of mutually separated passages, there being one of the last-mentioned passages for each of the separate tubular coils forming the said header being adapted to protrude through the shell of the heat exchanger such that a shoulder on the header bears against the interior of a shoulder piece on the heat exchanger shell, the protruding portion of the header having an external thread and as associated threaded union adapted to bear against the exterior of the shoulder piece on the heat exchanger shell and secure the header to the heat exchanger shell.

The following is a description by way of example of a preferred embodiment of the present invention, reference being had to the accompanying drawings, in which:

Fig. 1 is a sectional side elevation of the heat exchanger of the present invention.

Fig. 2 is a schematic view showing the exterior piping arrangement.

Fig. 3 is a plan view of a typical heating coil.

Fig. 4 is a side elevation of a typical heating coil.

Fig. 1 illustrates one embodiment of the heat exchanger of the present invention. The shell or body of this heat exchanger is formed from three main component parts which are a top section, a middle section and a bottom section.

The top section comprises a cylindrical shell 11, a domed top 12 and a flange 13. Associated with this top section is a heating coil 14 formed of four separate tubular concentric coils 15A, 15B, 15C and 15D joined to inlet header 17 and outlet header 16. The domed top 12 has an outlet opening 18.

The middle section is formed of a cylindrical shell 19, an upper flange 20, a lower flange 21 and a heating coil 14 which is identical with that in the top section and comprises four separate tubular concentric coils 15A, 15B, 15C and 15D joined to an inlet header 17 and an outlet header 16.

The bottom section of the heat exchanger comprises a cylindrical shell 22, a domed bottom piece 23 with an inlet opening 24 and a flange 25. This section has the same heating coil 14 as is used in the middle and upper sections. Also associated with the bottom section are three legs 26 which support the heat exchanger in the vertical position.

The top section flange 13 is joined to the middle section flange 20 by bolts 27 and the bottom section flange 25 is joined to the middle section flange 21 again by similar bolts 27.

Figs. 3 and 4 are detailed drawings of the actual heating coils used in the heat exchanger. Referring to these drawings, it will be seen that the inlet header 17 and also the outlet header 16, because they are identical, has a main fluid passage 28 which is connected to four individual pasageways 29, one leading to each of the separate tubular concentric coils. The inlet header is provided with a shoulder 30 which bears against a shoulder piece 31 which is welded into the shell of the heat exchanger. A protrusion 32 of the inlet header 17 extends through the shell of the heat exchanger to the exterior of the heat exchanger. This protrusion 32 has on its exterior surface a threaded portion 33 and an associated union 34. When this union is tightened up on the threaded section 33 it bears against the exterior part of the shoulder 31 on the heat exchanger shell, thus retaining the inlet header 17 in relation to the heat exchanger shell 12. As was mentioned before the outlet header 16 is identical to the inlet header 17 and is secured to the heat exchanger shell in identical fashion.

The protruding part of the inlet header has an internal thread 35 to which exterior pipe connections can readily be made.

Studying Fig. 3 it will be seen that the heating coil is somewhat eccentrically mounted within the heat exchanger and results in a space 36 on that side of the heat exchanger coil away from the header. This space 36 is sufficiently large to permit the whole heating coil to be moved away from the shell shoulder piece 31 permitting the protruding part of the headers to be brought within the shell of the heat exchanger and thus allowing the coil to be moved along the longitudinal axis of the shell for easy removal.

It has been found that having this coil eccentrically mounted within the heat exchanger does not interfere with the heat exchange properties of the coil. To ensure that the inlet fluid is properly distributed about the heat exchanger and in contact with the heating coils a diffuser 37 may be used in conjunction with the inlet opening 24.

Again referring to Figs. 3 and 4, it will be seen that the length of each separate tubular concentric coil forming the heating coil varies. Thus coil 15A has a longer travel or is longer in length than 15B; 15B is longer than 15C and 15C is longer than 15D. In an attempt to compensate for this difference in travel, in one embodiment of the present invention, different diameter tubes are used to form the separate tubular concentric coil. In one actual heat exchanger it was found that better results were obtained by forming the separate tubular concentric coils 15C and 15D from 5/8″ o.d tubing and tubular concentric coils 15A and 15B were formed from 3/4″ o.d. tubing.

The separate tubular concentric coils may be secured within the header in a variety of fashions. However, best results have been obtained by braizing, soldering or welding.

A typical exterior piping arrangement for the heat exchanger of the present invention is shown in Fig. 2. The source of heat, which frequently is steam, is fed to the heat exchanger by a pipe 38 which is connected to the inlet headers 17. Return pipe 39 conveys the heating fluid away from the return headers 16. These pipes 38 and 39 being connected to the headers by means of the internal threaded section 35. The fluid to be heated is fed to the heat exchanger via a pipe 40 which is connected to the inlet 24 and the resultant heated fluid is conveyed away from the outlet 18 by pipe 41.

It will be seen then that the heat exchanger of the present invntion has a great deal of flexibility inherent in its design. The minimum size of the heat exchanger is obtained when only two sections are used, a top section and a bottom section, to form a heat exchanger having two unit coils. A larger capacity heat exchanger can be formed by using a middle section and, of course, one, two or more middle sections can be employed to form a considerably larger unit. Yet in each case the component parts are identical and the cost of manufacture is considerably reduced.

By having the various sections bolted together repairs can be easily carried out. It is simply a matter of loosening a few bolts and lifting off a section and the whole interior of the heat exchanger is exposed. A damaged or leaking coil can be replaced easily. One advantage of the present unit is that it is quite easy to identify the coil which is leaking and if it is not needed for the heating capacity required at that time, one coil can easily be blocked off and the exchanger used with only the reamining coils operating. It is contemplated that this will not happen frequently since, as has been said before, there are no threaded connections within the heat exchanger

itself. Each of the separate tubular concentric coils is joined to the header by fitted connections which can be welded, soldered or braized and such connections are not easily damaged.

Another feature of the coils is that they are extremely well mounted within the heat exchanger shell. Each of the individual tubular concentric coils is securely mounted to the two headers and each header is rigidly mounted to the shell by means of the shoulder 30 on the header bearing against the interior of the shell shoulder 31, the whole coil being tightly held in place by the union 34.

WHAT I CLAIM IS:—

1. A heat exchanger comprising a shell having at least two sections, each of said sections being secured together by bolted flanges, one of said sections forming the top section of the heat exchanger and a second of said sections forming the bottom section of the heat exchanger, said top section having a cylindrical wall, a domed top and a heated fluid outlet, said bottom section having a cylindrical wall, a domed bottom and a cold fluid inlet, each section of said heat exchanger incorporating a heating coil comprising a series of separate tubular coils concentrically wound one within the other, each of said coils providing a helical passageway for heating fluid, the upper end of each coil being connected to an inlet header and the lower end of each coil being connected to an outlet header, each of said headers being provided with a main fluid passage connected to each of a plurality of mutually separated passages, there being one of the last-mentioned passages for each of the separate tubular coils forming the heating coil, said header being adapted to protrude through the shell of the heat exchanger such that a shoulder on the header bears against the interior of a shoulder piece on the heat exchanger shell, the protruding portion of said header having an external thread and an associated threaded union adapted to bear against the exterior of the shoulder piece on the heat exchanger shell and secure said header to the heat exchanger shell.

2. The heat exchanger as claimed in claim 1 in which the cold fluid inlet incorporates a diffuser.

3. The heat exchanger as claimed in claim 1 or 2 in which said heating coil comprises four separate tubular concentric coils.

4. The heat exchanger as claimed in claims 1, 2 or 3 in which the inner of said separate tubular concentric coils is formed from a smaller diameter tube than the outer of said separate tubular concentric coils.

5. The heat exchanger as claimed in claim 3 in which the two inner separate tubular concentric coils are formed from 5/8″ outside diameter tube and the two outer separate tubular concentric coils are formed from 3/4″ outside diameter tube.

6. The heat exchanger as claimed in any of claims 1, 2, 3, 4 or 5 in which said separate tubular concentric coils are secured to said header by braizing, soldering or welding.

7. The heat exchanger as claimed in any of claims 1, 2, 3, 4, 5 or 6 in which the protruding portion of said inlet header has an interior thread adapted to connect the pipe feeding the heating fluid to said heating coil.

8. A heat exchanger substantially as herein described with reference to and as shown in the accompanying drawings.

BROMHEAD & CO.,
Chartered Patent Agents,
Clifford's Inn,
Fetter Lane,
London, E.C.4.

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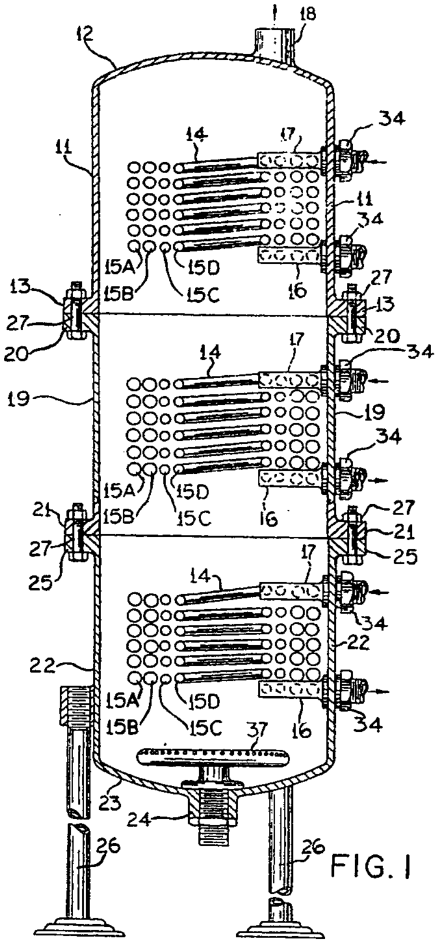
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FIG. 1

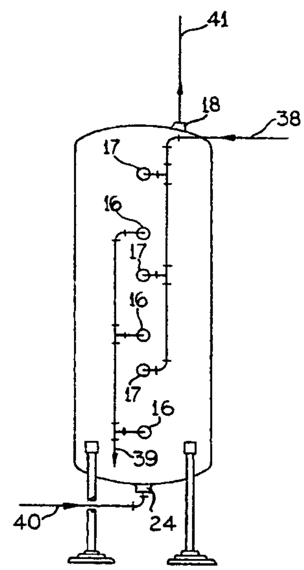
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FIG. 2

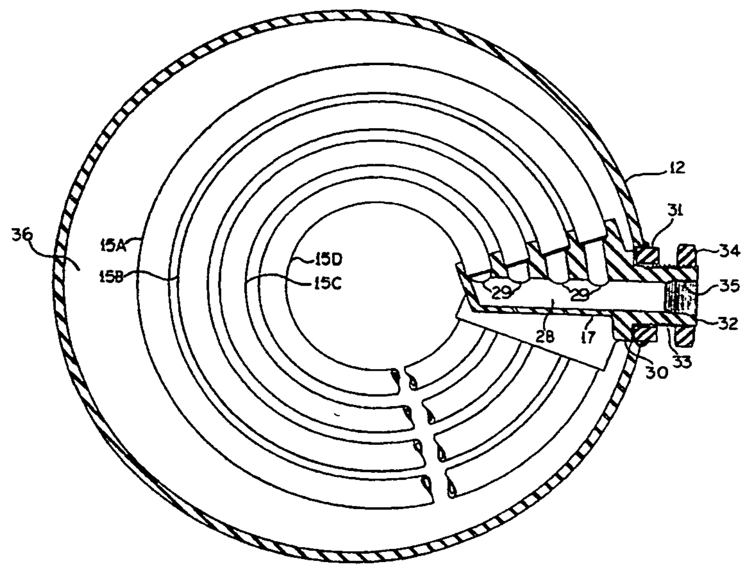
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FIG. 3

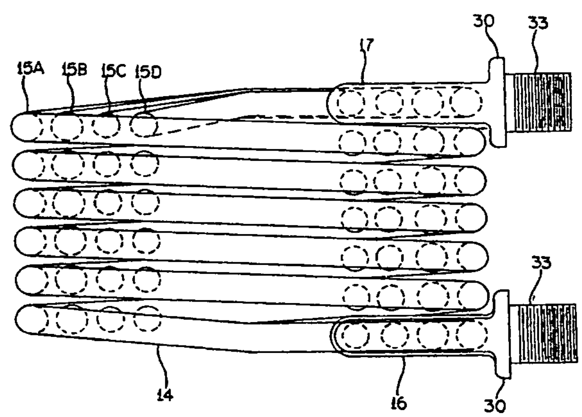
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FIG. 4